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THE NATURE OF EXPLANATION[1]

THE purpose this paper would accomplish is to define explanation, to compare it when defined with its genus, knowledge, and, finally, to examine some of its implications and general metaphysical bearings. So far as possible the problem will be kept isolated from other general problems and from the issues raised in solving them, for example, from the points in controversy between realism and idealism, and between rationalism and empiricism.

To explain is to analyze a whole into parts or a complexity into elements that are simpler and whose relations are simpler. This definition states that explanation is an analysis resulting in the discovery of parts or elements, that these parts or elements are simpler than the whole or complexity to which they belong and that the relations obtaining between them and other terms are simpler. The pragmatic value of explanation arises then from the fact that the simpler relationships which it discovers are easier guides of conduct.

Explanation thus defined bears what relation to its genus, knowledge? Psychology tells us that in the growth, or expansion, of information, no matter how interwoven and interfused the living mental processes may be, analysis reveals four processes usually present: to wit, new sensations, association, analytic attention and comparison. Important as the two former processes are in building up knowledge, still their office is rather to present the mind with the raw material that is to become known and, also, in the case of association, to keep the mind effectively in possession of the knowledge it has previously won. Mere sensation plus even extensive association would be knowledge only in the sense that mere sensation is knowledge, though, of course, it would be far more extensive, permanent and useful. Hence analysis and comparison are preeminently the cognitive processes, essential as the other two are; and the breaking up of a content or the unravelling of its components is preeminently what is meant by an increase of information.

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[1] A paper read before the American Philosophical Association, December 27, 1906.

Any further account of the nature of knowledge would force us to analyze the content, that is, to study the object known. Only by so doing shall we discover the most important element in judgment, the nature of the information asserted.

What does analysis find in the content? Unless our rationalism be of that extreme form which seems to have been shown to be thoroughly false, we can answer: *terms and relations.* Thus judgment, or knowledge in its maturer form, stands forth as the discovery and assertion of a relation between terms.

If this brief account of the nature of knowledge be correct, explanation differs from other types of knowledge merely by being more complete, for it seeks to analyze exhaustively. In short, we may speak of three stages of knowledge: first, mere analytic attention, or discrimination; secondly, judgment; and thirdly, explanation.

Let us return to our definition to examine its implications and general metaphysical bearings. "To explain is *to analyze* a whole into parts or a complexity into elements."

By analysis two quite different processes are implied; the first we may name *substitution,* the second is *analytic attention.* The former is probably more often used to denote scientific analysis, but only the latter should be called analysis. By substitution we refer to a large number of familiar epistemological facts. First in importance is the preference the mind has to focus in attention the content to be interpreted, that is, to substitute a clear perception in place of one that is vague. Again, there is the tendency to substitute for an object as actually perceived another that may be called its standard perception. For example, the table seen in perspective is not rectangular, but we think of it as such, we treat it as such; and the distant object is, as seen, small, but this we correct by substituting our information of it as seen from near by. Another familiar fact is the substitution of the object as seen under a high-power lens for it as seen by the naked eye or through a lens of low power, *e. g.,* the real brain is not that of gross anatomy, but that of histology. Here, again, a new substitution takes place. Beyond the reach of the microscope are the chemical molecules, and the real brain is built up of them. Even here we can not stop, for the chemical atom must give place to the ultimate entities of physics. Finally, our list would be quite incomplete did it not include the reduction of the secondary qualities to primary, and also those substitutions in science where symbols are dealt with in place of the concrete entities.

It is beyond the scope of this paper to interpret these various substitutions except generically. Our problem is: What makes the substituted content preferable to the original? There are at least two reasons: first, the substitute admits more readily of analysis, its structure being more complex or more open to view; secondly, its terms have more relations, simpler relations, or relations more frequently found and therefore revealing new similarities between objects and between their phenomena. In short, the substitute always gives a far richer or more valuable field for the work of explanation. Thus, though an essential part of explanation, its office is rather introductory to explanation, the latter beginning with analytic attention, or analysis proper.

Here one feels impelled to ask the question, By what right can we do this substituting and yet claim that we are explaining the original? The answer is, We can apply our explanation to the original only in so far as we know the relation or relations between it and its substitute. By this indirect means we learn how the truths our explanation has discovered hold of the original. These relations are various, and are by no means to be identified always with that between whole and part. On this account substitution is a better name for this process than analysis.

Let us consider next the nature of the process we have called analysis proper. Its nature may be made clear by showing what we mean by *simple* when we state that the parts or elements revealed by analysis are simpler and that their relations are simpler. What, then, does 'simple' mean, and are there absolute simples? The simple is the product of analysis, and analysis critically examined will always prove to be analytic attention at work dissecting some apprehended content. That is to say, we mean by the simples the elements or parts discriminated by analytic attention, and by the absolute simples those elements or parts which must forever baffle analytic attention.

That analytic attention does dissect apprehended contents, that the parts or elements thus discovered are simpler than the original content in the sense that sooner or later they commence to baffle analysis, and, finally, that there are parts, elements and relations in the apprehended contents which have until now completely baffled human analytic attention, are all truths easily verified. Of course, we may never be sure that analysis has anywhere reached a limit; but the increasing difficulty with which analysis progresses seems to indicate that we are in many places working at least on the borders of the absolutely simple. In short, the absolute simple is within reach.

This conclusion is open to two important objections. First, may not the real objects of the physical world be indefinitely complex? The proper reply to this objection should be apparent from the foregoing paragraphs. It confuses the two uses of the word analysis,—

substitution and analytic attention. Substitution may have no limits, but analytic attention does have its limits.

This failure to distinguish between the two processes seems to account, at least in part, for the difference in opinion among philosophers regarding the simple. Let reality be infinitely complex, this does not prevent the problem raised at any level of investigation from being solved by information whose terms and relations are simple, for simple terms and simple relations are always within the possible reach of analytic attention.

The second objection urges that knowledge is *organic,* and as such excludes the simple. To put a term in relation is to alter it, whereas the foregoing doctrine maintains that knowledge seeks and at least approximately finds simple terms which are not altered by standing in relation. Moreover, if this doctrine were correct, the sum total of truth would be an aggregate of monadic judgments. They would not constitute a system.

This opposing view contains four objections to which reply must be made. First, *to put a term in relation is to alter it.* But we do not literally put terms in relation, rather we *find* them in relation. Our analysis must not be confused with experimental analysis. To take out from a chemical compound one of its elements would no doubt change all radically. The analysis in explanation is purely an act of attention. We discriminate the terms and relations present in the content; and when we take a term out of relation, we merely turn our attention from the relation to the term. This alters neither.

Secondly, our thesis leaves the following questions quite open. Is the real so complex that it would take an infinity of judgments to interpret any part exhaustively? Or, is the real so truly unique that it would even then escape our judgments and require a higher type of knowledge, a higher immediacy, to apprehend?

Thirdly, we shall be told that a higher level of knowledge, just because knowledge is organic, alters all the truth as held at a lower level. This objection must be met by a flat denial. Hunt the history of science through, and produce a judgment partly true and partly false that can not be analyzed logically into at least two judgments, one quite true and the other totally false. In short, the half-truth of immature knowledge is due to deficient analysis, analysis of the type already examined, and would have been either completely false or completely true had this analysis gone farther. Should it be here objected, such half-truths must be forever the lot of man; we reply, When analysis has done its work exhaustively, then our judgments are either true or false. A higher level of knowledge either accepts or rejects them *in toto.*

Fourthly, Can such a mere aggregate of isolated judgments constitute a system? It can in the purely negative sense that no two judgments may contradict one another. It can so far as inference will carry us from ultimate simple judgments to such cognitive structures as pure mathematics and abstract mechanics. It can so far as some relations exist more numerously than do others. That is, though one simple judgment may not be simpler than another, it may hold more extensively, and thus we may get a principle of classification of judgments. Thus we may conclude, leaving it an open question whether or not a similar statement holds of the real, discursive knowledge in its final form promises to have as its premises a vast aggregate of isolated judgments. Explanation seeks simple terms and simple relations. To deny to science the right to isolate its problems would be to rob it of the instrument to which, above all others, it owes the success of the last two centuries.

Let us return once more to our definition. "To explain is to analyze a whole into parts or a complexity into elements." The definition points out that there are two distinct types of explanation. The first analyzes a whole into parts and, in the wide sense, is an atomic theory; whereas the second gives us abstract general laws. The two, though distinct, are not fundamentally different.

The parts into which a whole is divided are of two kinds. First, they may be entities which could exist quite independently, *e. g.*, the cells of a living body, the wheels of a watch. These are concrete entities. Second, the parts may be abstract entities, that is, parts from which so many properties are thought away,—or, better, to which so few properties are left,—that they would not be theoretically perceivable, *e. g.*, the mass particle of abstract mechanics.

These two types must be kept distinct. Confusing them has been one important cause of such a reaction against mechanism as the *Energetik*. An admirable illustration of confusion is given in Duhem's recent book, 'Physical Theory, Its Object and Structure.' He complains that the English physicists prefer to present things as seen or touched, and therefore they construct models for the details of theory. For them the ether is like glycerine or jelly. An atom is a vortex in a perfect fluid. Whereas for 'the French and Germans a physical theory is a logical system rigorously deduced and satisfying reason rather than imagination.'

Can we not clear up such confusion? If we mean by the existent that which is perceivable, it is invalid to talk of parts as existent which by definition are imperceivable. They are abstract entities. they are mere symbols, and should be treated as such. The rule indicating where the line is to be drawn between existent parts and symbolic parts is, of course, for the scientist to apply, but it is for the epistemologist to formulate. To talk of an entity and surreptitiously to imply that it is visible when it lacks the condition of visibility, namely, light, is nonsense. If the ether is conceived merely as a medium for the transit of light but is itself lightless, then we are not to talk of it in any terms that imply visibility. Is it like glycerine? Is it a sort of jelly? In some sense, maybe, but surely not in the sense that would make color a property; and probably only in a sense that would make the ether a highly abstract symbol. Thus Duhem is right, such models or similes lack logical precision.

It should here be pointed out also that concrete entities, though in one respect markedly different from the abstract entity or symbol, could nevertheless be arranged in a series which passes over by degrees into that entity, and in turn, a series of these abstract entities could be formed which would pass by degrees into the merely abstract property. So far as explanation is concerned, all this but means the concentration of attention upon a narrower and narrower field; for attention is always dealing with the original, at least in one of its parts or elements, even when we substitute for them mathematical or other signs. To misunderstand this is to misunderstand the nature of explanation, is to regard it, as has been so commonly done from the days of the Greeks until now, as explaining the original literally by means of new entities working behind the scenes. To explain is to describe.

Our definition thus makes the metaphysical status of atomism evident. Atomism can be one of two things, a theory of existent entities and a merely methodological device. In fact, it is both. The former it is and should be only so long as the atoms are thought of as perceivable. It passes into the other the moment the entities are abstract, that is, are symbols. The question at issue between the *Energetik* and mechanism should not be, Are all physical events existentially the motion of mass particles? but, Do the laws and equations of kinetic energy hold of all the other energies, and are they logically more simple? If so, the other energies may be symbolized in terms of mechanism, and atomism here becomes merely a methodological device.

Finally, we come to the last element in our definition: Explanation seeks parts or elements whose relations are simple. The simple relations are the common ones and these, when formulated, give general abstract laws. Thus our definition harmonizes with the usual one,—to explain is to find a universal under which the particular case can be brought.

WALTER T. MARVIN.

PRINCETON UNIVERSITY.